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THE GROWING of FLAX

Contributed by
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Foundation Stock of ROYAL Flax on University Seed Farm at Saskatoon in July, 1939.

SASKATOON, SASKATCHEWAN

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THE GROWING OF FLAX

By J. B. HARRINGTON

IN 1943 Canada produced 17,911,000 bushels of flax from 2,948,000 acres, the average yield being 6.1 bushels per acre. All but 291,000 bushels of this were produced in the three prairie provinces. Saskatchewan alone accounted for 11,500,000 bushels or 64.3% of the total Canadian crop. The rise of the flax acreage to the 1943 peak and its subsequent fall to almost the 1941 level is shown in the following tabulation taken from the reports of the Dominion Bureau of Statistics:

Year	Canada		W. Canada		Saskatchewan	
	— ,000 Acres	— ,000 Bushels	— ,000 Acres	— ,000 Bushels	— ,000 Acres	— ,000 Bushels
1941.....	996	6,566	982	6,419	681	4,086
1942.....	1,492	14,991	1,466	14,700	1,056	10,500
1943.....	2,948	17,911	2,918	17,600	2,084	11,500
1944.....	1,323	9,668	1,297	9,405	939	6,400
1945.....	1,059	7,593	1,034	7,338	655	3,800
1946.....	1,008	7,651	990	7,475	557	3,350

During the ten years just prior to the war, Canada's average flax crop was worth \$2,222,000. The value of the 1943 crop was \$39,000,000. The 1946 crop, although consisting of only half as many bushels, is worth approximately \$25,000,000.

During recent years there has been a decided shift in the areas of more intense flax production in Saskatchewan. In 1942 and 1943 flax production, while distributed over the Province, was concentrated in the west central and south central areas. Disappointing yields accompanied by weedy fields resulted in rapidly decreasing acreages during the next three years. Meanwhile the proportion of flax in the extreme southern and southeastern areas steadily increased until in 1946 the southeast was the area with the largest proportion of the Province's flax crop. The increased popularity of flax in the southeast may be attributed in part at least to reasonably good moisture conditions plus the fact that Royal and Viking are resistant to both wilt and rust and higher in yield than the old varieties.

The varietal situation has also changed markedly during the period 1941 to 1946. Bison, which was very prominent in 1941, has almost disappeared from the Province. It has been replaced largely by Royal and to some extent by Viking and Victory. Redwing is still popular in the north, but has been replaced on the open plains by Royal to a large extent.

NEW DEVELOPMENTS IN FLAX PRODUCTION

The new developments in flax production are: (1) the use of the oneway disc for seeding the crop on heavy clay soils, (2) the growing of flax as a stubble crop, (3) the use of a mercuric dust seed treatment, (4) the use of phosphate fertilizers, (5) the trend toward swathing instead of straight combining, (6) the probable use of a depth control attachment on drills, and (7) the use of new disease resistant varieties.

FLAX COMPARED WITH WHEAT AS A CASH CROP

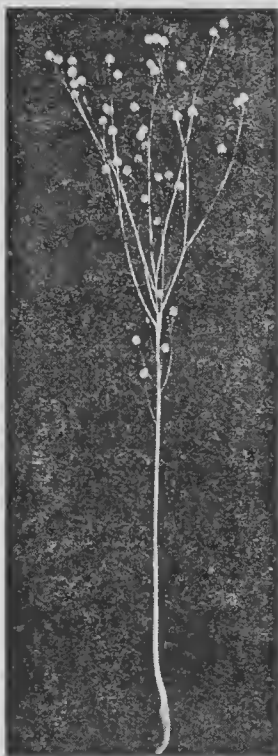
Advantages of flax compared with wheat. Flax (a) is an alternate cash crop which can sometimes command a market when wheat marketing is restricted; (b) can be grown with the use of the same farm implements as required for wheat; (c) is much less damaged by wireworms than wheat and therefore is especially useful as a cash crop on breaking; (d) is not affected by the wheat stem sawfly; (e) is fairly short strawed in most parts of Saskatchewan and rarely suffers from lodging; (f) is less easily injured by fall frosts than wheat; (g) makes a more ideal combine crop as the seed does not shatter easily and is very resistant to after-harvest weathering; (h) when unavoidably left in the field over winter flax is usually a satisfactorily marketable crop in the spring whereas wheat generally suffers severe deterioration; (i) as a substitute for part of the wheat acreage, extends the period of usefulness of a combine and reduces the risk of loss from wireworms, sawflies and unfavorable weather; (j) is much less subject than wheat to losses in grade caused by after-harvest weathering; (k) requires less farm storage space per unit of value than wheat; (l) is worth more per hundred pounds and therefore cheaper to haul and ship; (m) requires no twine when cut with a binder.

Disadvantages of flax compared with wheat. Flax (a) requires very careful seed cleaning to insure removal of all weed seeds; (b) needs more careful soil preparation and control of seeding depth than wheat; (c) should be sown when the soil is moist and the weather warm enough to promote rapid growth whereas wheat is not so exacting; (d) has seedlings which are distinctly less able than wheat to force their way through a surface crust resulting from a heavy rain, consequently an occasional flax crop requires harrowing to facilitate the emergence of the seedlings; (e) suffers more from spring frosts because the seedlings, when about an inch high, may be killed by a severe frost, whereas damaged wheat seedlings will grow again, even if frozen off to the ground; (f) suffers more severely from cutworms and grasshoppers; (g) is a crop which does not grow sufficiently vigorously or shade the ground enough to control weeds, whereas wheat is fairly good in this respect; (h) is troublesome and expensive to cut if the crop was sown late and the stems are green; (i) requires more time and care for threshing; (j) requires covering of small holes and cracks in wagon boxes, bins and freight cars as the seed easily escapes from such openings; (k) has a less stable market price than wheat.

Relative yields of flax and wheat. The average yield on clean summer-fallow at Saskatoon for the period 1925 through 1943 was 13.9 bushels per acre for flax and 25.2 bushels per acre for Marquis wheat. The highest flax yield was 33.9 bushels in 1942 and the highest Marquis yield was 58.7 bushels in 1942. The lowest flax yield was 1.3 bushels in 1937 and the lowest Marquis yield was 3.0 bushels in 1937. The general average yield in Canada for the period 1925 through 1943 was 6.5 bushels per acre for flax and 14.7 bushels per acre for spring wheat. These figures show that flax yielded almost half as well as wheat on the average.

Areas of Saskatchewan where flax production is the safest proposition in comparison with wheat. During the years when there was much new breaking flax was grown satisfactorily in most of the settled areas of the Province. During the past ten years production has been chiefly in the heavy clay soils of west-central and south-central Saskatchewan. Unless one is experienced as a flax grower it would be unwise to risk growing the crop where attack from cutworms or grasshoppers is expected or where soil drifting is likely, as wheat is a much safer crop under such conditions.

Flax compared with wheat as to price. During the past 12 years the street price of flax has varied from $1\frac{1}{2}$ to $2\frac{3}{4}$ times the price of wheat at Saskatoon. The freight on flax is much less in proportion to value than on wheat. If the cost of threshing and hauling to market is considered, flax has the disadvantage of higher threshing costs than wheat and the advantage of a lower cost of hauling. Experienced flax growers feel that flax must be worth at the local elevator at least $2\frac{1}{2}$ times as much per bushel as wheat in order for flax production to pay.



Royal Sask. 1727

The comparative effect on the land of flax and wheat. Experimental evidence indicates that a clean crop of flax is no "harder on the land" than an equally clean crop of wheat. When a flax crop is very weedy the weeds probably take much more moisture and plant food from the soil than does the flax. Then again, most of the flax sown in the past was of varieties susceptible to wilt, a soil-borne disease, and successive crops of flax on the same land gave poorer and poorer yields due to the ravages of the disease even though several years elapsed between successive croppings.

PREPARATION OF SOIL AND METHOD OF SEEDING

Flax on breaking. Before seeding the land is levelled by the necessary amount of harrowing, or discing and harrowing. Seeding is usually done with a double disc drill at a depth of one to two inches, depending on the soil type and moisture conditions.

Summerfallow versus stubble. Very little summerfallow is free from weed seeds, consequently any crop sown on fallow is likely to meet weed competition. If seeding is delayed until a crop of weeds is destroyed, flax as a crop suffers a handicap for it usually takes distinctly longer than wheat to mature and the plentiful amount of moisture and plant food in summerfallow tend to prolong the growing period. If, on the other hand, the flax is sown early on summerfallow, the cold soil often delays germination and gives the weeds an excellent opportunity to get ahead of the flax. But wheat, oats and barley are

almost ideal on fallow. They make a strong start and are far more successful than flax in competing with the weeds.

Flax sown on stubble land very frequently is freer from weeds than summerfallow flax. Stubble land is handled in various ways, depending on conditions, but as a rule flax is sown later on stubble than on fallow. The soil is relatively warm and the flax makes a good start. Of course the yield expectation is not as high as in the case of summerfallow crop, but that is true regardless of the crop sown. On the whole the trend toward using flax as a second crop after wheat, barley or oats instead of as a summerfallow crop seems to be sound.

Flax on summerfallow. The land should be as free from weeds as possible. Before seeding the soil is levelled with a drag harrow, possibly preceded by double discing or duckfooting. Most of the flax grown on the dark brown soils of the park belt region of the Prairie Provinces is sown on summerfallow or breaking. The ideal flax land of Western Canada is the heavy clay soil of west-central and south-central Saskatchewan. The proportion of flax drill sown on summerfallow in these areas is diminishing rapidly in favor of flax sown on stubble and with the oneway.

Most summerfallow contains weed seeds and the flax grower attempts to eliminate at least one crop of weeds before sowing his crop. After spring discing or harrowing it usually takes two weeks for the weeds to make a good start, and seeding may be delayed until about May 15th or 20th.

On the Elstow silt clay loam of the University Experimental Farm at Saskatoon the flax is sown on summerfallow with a double disc drill without the chains. The land is prepared by levelling with the drag harrows about May 15th just before seeding. This eliminates a crop of young weeds and furnishes a firm moist seed bed for the flax. The depth of seeding is adjusted

so that the seed will be about 1½ inches below the soil level in the drill furrows. If discing is necessary before the harrowing the soil is packed before seeding. This method of seeding has been very successful at Saskatoon for many years.

On the Elstow loam west of Saskatoon one very successful flax grower harrows his summerfallow early in the spring, allows the weeds to grow and cultivates them out two or three weeks later. About the second week in May he harrows and packs the soil and seeds with a press drill.

Flax growers in southwestern Saskatchewan and southeastern Alberta get good results from delaying their seeding until they have killed two, and even three, crops of Russian thistles and other weeds. Where the season is moderately long this delay is not serious.

The Melfort and Tisdale silt-clay loam of northeastern Saskatchewan is a different proposition than the heavy clay soils of the open plains. The soil bakes readily and the climate is moderately moist, consequently it is important to sow flax relatively shallow. Packing after seeding is usually undesirable. Very little flax is sown there with a oneway. The same comments apply more or less to most of the dark brown soils of the park belt. In all of these areas most of the flax is sown on summerfallow.

Flax on stubble land. The practice of sowing flax on stubble land has increased tremendously in recent years. This has been due to several factors among them being (1) the efficiency of sowing with the oneway with a drill attachment, (2) the warmer soil and quicker growth on stubble as compared with fallow, and (3) the weediness of most summerfallow requiring more weed control tillage in the spring when the land is used for flax than when wheat is grown.

Stubble land should be disced lightly in the fall soon after harvest, unless there is considerable danger of this resulting in soil drifting. The fall discing will start many weeds if there are early fall rains. The stubble holds the snow and prevents drifting of the soil in the early spring. If the soil contains many weed seeds, particularly Russian thistles or wild oats, it may be advisable to delay seeding until one or two crops of weeds are eradicated. Where no fall cultivation has been done the land can be lightly disced early in the spring to cover the surface weed seeds and encourage germination. After spring discing it usually takes two weeks for a crop of weeds to make a good start, consequently the seeding of flax may be delayed until about the third week of May.

Heavy stubble may be eliminated previously by burning. While stubble burning is not good as a regular practice the burning of tall heavy stubble is helpful as it kills some weed seeds and allows a good seed bed to be made where otherwise the soil would not be sufficiently moist, uniform and compact. In the areas of western and southwestern Saskatchewan infested with Russian thistles stubble nearly always is burned if flax is to be sown.

A good deal of flax is sown on stubble on the sandy loam soils west of Saskatoon. In order to avoid soil drifting relatively little summerfallowing is done and stubble sown flax has been successful for many years. A typical procedure is to leave the land untouched until about May 10th, then plow and pack, or oneway and pack, following immediately with a double disc or a press drill. The danger of drifting soil injuring the young flax seedlings is much less if a press drill is used. The seed is sown at a depth of about one inch below the soil level in the drill furrows.

If wild oats are prevalent they are covered by light discing in the fall or early spring. When the wild oat seedlings are about four inches high they are eradicated, preferably with a rod weeder, and the flax is sown a few days later.

The use of the oneway for sowing flax on stubble. During the past three years, the use of the oneway disc for seeding flax has increased enormously in Western Canada. One reason for this is the accuracy of the new seeder attachments as compared with the inaccuracy of the old worn drills. Another seems to be the spreading or scattering of the seed by the oneway allowing a more complete soil coverage by the flax plants than is obtained with a drill.

The usefulness of the oneway for seeding flax depends greatly on the character of the soil. It is most useful on the so-called "loose top" dark

Flax is then too slow in emerging and consequently does not crowd out weeds as much as it would if sown shallower

clay soil (Sceptre heavy clay) of the Elrose-Eston area. That soil is self mulching and flax sown with a drill must be put at least two inches deep in order to obtain a good stand. The oneway does a good job of seeding about $2\frac{1}{2}$ inches deep. Even with heavy rains following seeding, the soil crust soon breaks naturally into many small pieces thereby not interfering with emergence. On the Regina Plains (Regina heavy clay) the soil is not a loose-top but it granulates easily and there is relatively little danger of crusts preventing emergence. If the present trend continues for another year or two most of the flax of the Sceptre and Regina heavy clay areas will be sown with the oneway. The land is not touched until about May 15th. Then the stubble, if heavy, is burned off and the flax sown with a oneway having a seeding attachment. Most of the unevenness in the depth of the flax seed may be eliminated by diagonal harrowing with flexible harrows.

Controlling the depth of seeding. One of the greatest worries of the flax grower is getting a uniform good stand. Most fields vary in the texture and compactness of the soil and a drill set to sow flax $1\frac{1}{2}$ inches deep may put it three inches deep in loose soil and less than one inch deep in the firm places. To enable the farmer to sow all the seed at a uniform depth, a flax grower of Asquith, Sask., invented a depth control disc to be fastened in pairs to each set of discs on a double disc drill. Each depth control disc is bevelled at its edge for a distance of about two inches. The cutting edges of the drill discs extend to the desired seeding depth beyond the bevelled edges of the attachment. When the drill is in operation the bevelled edges of the attached discs form a V shaped furrow and the seed is sown about $1\frac{1}{2}$ inches below the soil level at the bottom of the V. When heavy pressure is put on the drill discs they penetrate firm soil satisfactorily yet the depth control discs prevent them from sinking appreciably deeper into loose soil. Thus the seed is sown at a uniform depth of $1\frac{1}{2}$ inches below the soil surface in the drill furrows. The new device has attracted considerable attention and deserves extensive trial in Western Canada.

PREPARATION OF SEED FOR SOWING

Avoid cracks
Cleaning the seed. Flax seed requires careful cleaning to eliminate weed seeds and all inert matter which might interfere with a uniform flow of seed from the drill. Weeds are probably the greatest menace to flax production and the use of clean seed is essential for satisfactory results. Most fanning mills, when properly used, will do a fairly good job of removing weed seeds from flax. It is much easier to remove weeds from large seeded flax varieties than from a small seeded variety like Redwing.

Seed treatment. Flax seed should be treated with mercuric dust, such as Ceresan or Leytosan. Nearly all of the flax seed of Western Canada requires treatment because minute cracks in the seed coats allow micro-organisms in the soil to kill the seed before germination takes place unless chemical dusts prevent this from happening. One ounce of Ceresan or Leytosan per bushel of seed gives satisfactory control in Saskatchewan. In Manitoba $1\frac{1}{2}$ ounces is recommended. Ceresan should not be applied more than a month before seeding.

Keep dry.

TIME OF SEEDING

Flax should be sown as soon as the soil is moderately warm which is usually about the second week in May or about a week after wheat seeding commences. Cold soil retards germination and emergence and gives the weeds a chance to get ahead of the flax. If early May is cold (as in 1943) flax seeding should be delayed until the weather is reasonably warm. Where seeding is delayed until a crop of weeds is killed it is well to remember that most flax varieties take longer than Marquis wheat to mature.

Seeding is sometimes delayed to avoid spring frost damage. This is a mistake, as the disadvantages of late seeding usually outweigh the advantages. Flax variety tests and increase fields have been sown at Saskatoon for the past 30 years during the period May 8th to 18th and have suffered very little spring frost damage. When flax emerges it is fairly resistant to frost, then for a few days it is less resistant and thereafter it shows great resistance again. If a flax seedling is severely frosted soon after it has put out its first pair or two of true leaves it

may be killed. A great many fields of Bison flax in Saskatchewan in 1942 were thinned considerably by severe frosts in early June. This, however, is an unusual occurrence.

Ordinarily flax should be sown before May 20th. Excepting in the southern parts of Saskatchewan and Manitoba, flax sown after May 25th will often be troublesome to harvest and low in yield and grade. However, it must be recognized that flax sown on stubble usually ripens in less time than a summerfallow crop and can therefore be sown later.

AMOUNT TO SOW

For a variety with medium sized seed, like Royal, from 25 to 40 pounds of seed per acre is recommended. A sound basis is a rate of 28 pounds per acre for good seed of medium size treated with a mercuric dust and sown with a commercial fertilizer about May 15th on well prepared summerfallow on a moderately heavy clay soil reasonably free from weeds on the open plains. The basic rate should be modified to suit conditions. For example, it should be increased where the seed is large, the germination low, the soil especially rich or moist, the seeding late, the soil weedy, or thinning from cutworms, frost or harrowing is expected.

FERTILIZATION

Increased flax yields may be expected from the use of 20 to 25 pounds of 11-48 ammonium phosphate per acre on summerfallow, especially where moisture conditions are favorable. Stubble crops should not be fertilized unless the moisture conditions are distinctly favorable. One of the most beneficial results of fertilization is the stimulation of growth. The flax plants by growing faster and being leafier are better able to control weeds.

DEPTH OF SOWING

The flax seedling is weak when emerging and will not be able to push through a tight hard soil or break a thick surface crust. Flax should be sown into moderately firm moist soil but no deeper than is necessary to obtain a uniform germination. On medium light to medium heavy soils a depth of about 1½ inches is generally satisfactory.

The ideal flax land of Western Canada is the heavy clay soil of the open plains. Most of this soil is more or less self mulching and the best success with flax has been obtained from sowing 2 to 2½ inches deep either with a drill or the oneway. A double disc drill is especially satisfactory on summerfallow.

CARE OF THE CROP

Weeds. If thousands of small weeds make their appearance before the flax emerges it is wise to harrow the crop lightly in a diagonal direction immediately. This kills the weeds without seriously injuring the flax. If this harrowing is anticipated it is a good sign to sow slightly deeper and at a little higher rate than otherwise. The harrowing should be done when the soil is warm very soon after the flax has germinated and before the seedlings have gotten close to the surface.

Cutworms and grasshoppers. Poisoned bait applied in the proper manner will afford protection from the red back cutworm and from grasshoppers.

Detailed instructions are obtainable from the Dominion Entomological Laboratory at the University of Saskatchewan.

HARVESTING AND THRESHING

Harvesting with a binder. Early sown flax is not at all difficult to cut when it is fully ripe. Flax makes a good combine crop as it does not shatter easily. When a binder is used no twine is necessary. Some people remove the packing and binding parts and substitute a flax attachment, but this is not essential. Late sown flax often continues to blossom until late in the fall and the stems never get thoroughly ripe. Such material is difficult to cut owing to the toughness and gumminess of the unripe flax.

Threshing. Early sown flax is usually easy to thresh because it becomes fully mature before it is harvested. Two to four rows of concave teeth should be used according to the condition of the flax. The threshing machine should be operated a little under regular speed in order to control the cleaning at the shoe and prevent possible loss of flax seed with the straw. Loose flax should be pitched evenly in small forkfuls into the feeder. A flax sieve with 5/32" round holes should be placed level below the adjustable sieve to facilitate cleaning. When the flax is tough, six sows of concave teeth should be used and the normal speed of the machine should be maintained. Late sown flax is usually difficult to thresh on account of the presence of unripe material.

Using a combine. Most flax is now harvested with a combine. A great deal of flax, however, cannot be straight combined satisfactorily on account of the presence of tall green weeds throughout the crop. Some people delay combining until fall frosts kill the weeds and they dry out. This is a risky procedure as severe killing frosts often do not occur until late in October. A method which is rapidly growing in favor is that of swathing the crop. While this method requires more equipment it is very satisfactory for flax with green growth (usually called second growth) or partially green weeds as the swaths soon become dry enough for combining. In fact a variety like Royal, which is moderately late maturing and inclined to be hard to thresh, should be swathed unless it is sown early enough to ripen thoroughly.

Frequently combined flax has a large proportion of cracked seed. According to agricultural engineers the chief cause of cracking is to let the return throw the grain directly on top of the cylinder. To reduce the cracking the return should be adjusted so that the return grain is thrown back of the cylinder.

Weathering. Flax is far superior to wheat, oats or barley in resistance to weather damage. In experiments at Saskatoon, flax and wheat were left standing side by side after they were ripe. After several days of wet weather the wheat was badly bleached, whereas the flax showed no appreciable deterioration. Stooked or windrowed flax will retain its brightness and color after wheat, oats and barley have become badly bleached and discolored. Flax is highly resistant to after-harvest sprouting and will stand being left until spring unthreshed in the field far better than the cereals.

FLAX AND CEREALS IN COMBINATION

Flax with wheat. Combination cropping is a method of growing flax. At Saskatoon a good combination results from sowing a half bushel each of flax and wheat, the two crops being sown together. Some people sow the wheat and flax separately to avoid getting the flax in too deeply. Redwing flax takes approximately the same time to mature as Marquis wheat, whereas Royal is about a week later. The advantages of combination cropping of flax and wheat are: (1) if wireworms are present they damage the flax much less than the wheat, (2) if cutworms are present they damage the wheat less than the flax, (3) if a crust forms before the flax emerges the wheat seedlings will break it, thereby acting as a nurse crop, (4) the wheat aids the flax in competing with weeds, and (5) the crop is easier to cut than flax alone. The disadvantages are: (1) to insure a good job of sowing it is sometimes necessary to sow the wheat and flax separately, (2) the wheat and flax must be separated when marketed, (3) small pieces

of broken wheat remaining in the clean flax lower the value and grade of the flax as the percentage of oil extracted is lowered through the absorption of oil by the wheat particles.

Oats or barley in combination with flax. Oats are much less satisfactory than wheat as a combination crop with flax. This is because the oats grow more luxuriantly than wheat and tend to choke the growth of the flax. For those who wish to risk growing oats with flax it is suggested that $\frac{2}{3}$ bushel of oats and $\frac{1}{2}$ bushel of flax be sown. The seeding of the oats should be done separately from the seeding of the flax as the two seeds do not run evenly from the drill when mixed and the flax should be sown shallower than the oats. As for barley, the root system of this crop occupies the soil so completely that flax grown with barley is choked out to a considerable extent. Combination cropping of barley and flax, therefore, is not recommended.

CHOICE OF VARIETY

Two varieties, Royal and Redwing, are recommended for Saskatchewan and one of these should be used. In addition to these there are the old varieties, Crown and Bison, the use of which is a risky proposition, and the short strawed varieties, Viking and Victory, which do well under moist conditions.

TABLE 1.—Comparative results on yield, earliness and plant height for flax varieties on summerfallow at the University of Saskatchewan at Saskatoon.

Seed Yields in Bushels per Acre.

Variety	1939	1940	1941	1942	1943	1944	1945	1946	Averages	
									1932-46	1943-46
Royal.....	15.5	21.0	5.8	33.9	15.6	20.9	14.0	8.4	13.6	14.7
Redwing.....	11.5	18.3	4.0	20.1	14.5	19.3	10.1	9.2	11.4	13.3
Bison.....	11.5	19.8	4.7	26.0	14.6	14.7	13.7	9.6	11.8	13.2
Crystal.....	—	—	6.0	27.7	17.1	21.3	12.8	7.8	—	14.8
Koto.....	12.2	18.1	5.4	24.5	13.0	19.9	—	—	—	—
Victory.....	—	—	8.0	24.6	17.7	23.1	11.7	11.3	—	16.0
Viking.....	10.0	20.4	4.8	—	14.2	20.2	8.9	9.8	—	13.3
Arrow.....	—	—	—	—	18.1	21.5	13.7	10.1	—	15.8
Necessary Difference *	2.7	2.1	1.5	1.4	2.0	3.2	2.2	2.3	0.5	1.2

Days from Seeding to Maturity

Variety	1939	1940	1941	1942	1943	1944	1945	1946	Averages	
									1932-46	1943-46
Royal.....	93	108	87	119	118	103	96	102	99	105
Redwing.....	85	100	85	113	113	91	90	90	93	96
Bison.....	90	104	86	115	114	95	96	97	98	100
Crystal.....	—	—	85	117	116	97	96	102	—	103
Koto.....	91	103	85	116	114	96	—	—	—	—
Victory.....	—	—	85	119	119	97	92	100	—	102
Viking.....	99	107	87	—	116	102	100	103	—	105
Arrow.....	—	—	—	—	115	95	94	96	—	100

Height of Plant in Inches

Variety	1939	1940	1941	1942	1943	1944	1945	1946	Averages	
									1932-46	1943-46
Royal.....	19.8	20.8	15.0	25.1	14.2	23.2	14.5	16.5	18.7	17.1
Redwing.....	20.5	24.0	13.8	23.2	17.8	21.2	15.0	17.2	18.5	17.8
Bison.....	20.5	24.0	15.0	23.6	16.5	22.0	15.2	18.5	19.3	18.0
Crystal.....	—	—	14.2	22.8	16.5	24.0	15.8	18.0	—	18.1
Koto.....	—	—	14.2	22.9	18.0	22.0	—	—	—	—
Victory.....	—	—	14.5	20.5	13.8	20.8	14.0	18.8	—	16.8
Viking.....	16.9	19.0	10.5	—	13.0	21.0	13.0	15.0	—	15.5
Arrow.....	—	—	—	—	18.5	24.5	17.2	19.8	—	20.0

*If the difference between two varieties exceeds the Necessary Difference the varieties are considered to differ significantly in yield.

RECOMMENDED VARIETIES

Royal is a rust resistant, wilt resistant variety selected from Crown at the University of Saskatchewan in 1927 in the course of the cereal breeding investigations, and first distributed to the public in 1938. Aside from its disease resistance the particular virtue of Royal is its high yielding capacity. Royal has mid-sized blue blossoms and mid-sized brown seeds with a characteristic shading off toward white at the big end. Royal is high in percentage of oil and has satisfactory oil quality. It is moderately late maturing and moderately strong strawed, high in spring frost resistance, high in shattering resistance and slightly hard to thresh. Royal is recommended for Cereal Zones 1A, 1B, 2A, 2B, 2C, 2D, 2E, 2F, 3A, 3B and 3C, which constitute all of the open plains area plus the southeastern and east-central park belt.

The spectacular wartime rise in the production of Royal in Saskatchewan from 1941 when only about 600 bushels of seed were available to 1944 when an estimated 4,000,000 bushels were produced is shown in the following tabulation:

Year	Acres	Bushels	% of total flax acreage
1941.....	1,000	9,000	0.2
1942.....	18,000	225,000	2.1
1943.....	445,000	3,000,000	25.0
1944.....	569,000	4,047,000	63.2
1945.....	491,000	2,850,000	75.0
1946.....	446,000	3,240,000	80.0

Redwing is susceptible to rust but resistant to wilt. This variety resulted from selection at the Minnesota Agricultural Experiment Station and was introduced into Western Canada in 1932. It has blue blossoms and somewhat small brown seeds. Redwing averages distinctly lower than Royal in yield on the open plains, and where there is a rust epidemic it is also lower in the park belt, but under non-rust conditions Redwing excels in the northern and northeastern area. Compared with Royal, Redwing is lower in oil extraction, higher in oil quality, about a week earlier maturing with slightly stronger and longer straw. Redwing is recommended for Zones 3B, 3D, 3E, 3F, 3H, 4A and 4B, which constitute the eastern and northern park belt and the forest region.

OLD STANDARD VARIETIES NO LONGER RECOMMENDED

Bison was originated by selection at the North Dakota Agricultural Experiment Station and was introduced into Saskatchewan in 1930. Bison is susceptible to rust but highly resistant to wilt. It has blue blossoms and brown seeds slightly larger than those of Royal. Compared with Royal, Bison averages distinctly lower in yield, equal or slightly better in oil extraction, equal in oil quality, one to two days earlier, with equally strong, slightly longer straw, and is much less resistant to spring frost injury.

Crown is an old vigorous wilt susceptible variety which is rust resistant and yields well on soil which has not grown flax previously. However, on soil previously cropped with flax the yield of Crown may be reduced by wilt as much as 50% to 90%. Under wilt free conditions Crown has yielded almost as well as Royal. Crown resembles Royal in blossom color and seed appearance.

OTHER VARIETIES NOT RECOMMENDED

These include Biwing, Bolley Golden, Buda, Premost, Redson, Smoky Golden, Viking and Walsh. Viking has attracted the most attention.

Viking has large yellow seeds and good quality. It resembles Royal in lateness, yields somewhat less and has much shorter straw. The very short straw of Viking is its chief disadvantage. This variety has been used widely in North Dakota but is now giving way to Victory.

Smoky Golden has large tawny colored seed, is earlier, yields less, and is not as short strawed as Viking. Like Viking, it is high in oil quality.

TABLE 2.—Comparative yields, earliness and height of flax varieties on summerfallow at the Four Dominion Experimental Stations of Saskatchewan during the period 1941 to 1943 *

Variety and location of test	Seed yield in bushels per acre			Average	Days from seeding to maturity			Average	Height of plant in inches			Average
	1941	1942	1943		1941	1942	1943		1941	1942	1943	
Scott												
Royal.....	10.0	14.7	10.3	11.7	88	118	127	111	16.8	23.0	15.4	18.4
Redwing.....	8.6	15.1	8.0	10.6	82	110	118	103	17.0	23.4	15.3	18.6
Bison.....	9.6	18.6	10.5	12.9	88	113	122	108	17.5	23.1	15.6	18.7
Viking.....	9.3	20.6	12.0	14.0	87	120	128	112	14.8	21.0	12.0	15.0
Koto.....	9.2	17.8	8.8	11.9	86	112	119	106	17.3	23.9	15.4	18.9
Indian Head												
Royal.....	23.1	33.4	17.8	24.8	109	124	106	113	17.5	24.8	18.5	20.3
Redwing.....	18.2	23.7	14.4	18.8	112	121	101	111	19.5	23.5	16.8	19.9
Bison.....	18.2	26.5	15.9	20.2	110	124	105	113	19.8	24.0	18.5	20.8
Viking.....	21.1	31.1	19.3	23.8	108	125	107	113	15.3	20.0	14.8	16.7
Koto.....	18.9	25.9	16.8	20.5	104	124	105	111	19.0	22.5	18.5	20.0
Victory.....	—	27.8	19.0	—	—	118	106	—	—	23.8	16.3	—
Melfort												
Royal.....	10.2	17.9	16.1	14.7	94	127	131	117	17.0	26.3	17.0	20.1
Redwing.....	10.3	22.0	13.8	15.4	88	116	114	106	17.5	24.3	15.5	19.1
Bison.....	9.7	20.4	14.4	14.8	93	122	123	113	18.0	24.3	17.5	19.9
Viking.....	11.1	19.5	14.8	15.1	88	127	132	116	15.0	17.7	13.5	15.4
Koto.....	—	19.8	13.4	—	—	124	126	—	—	25.3	16.0	—
Victory.....	—	—	15.9	—	—	—	123	—	—	—	15.0	—
Swift Current												
Royal.....	o	19.9	10.5	15.2	o	o	117.2	—	o	26.2	15.6	20.9
Redwing.....	o	12.2	8.0	10.1	o	o	116.6	—	o	25.6	16.4	21.0
Bison.....	o	19.4	8.4	13.9	o	o	117.0	—	o	26.6	17.0	21.8
Viking.....	o	23.2	9.0	16.1	o	o	o	—	o	19.4	13.6	16.5
Koto.....	o	20.3	9.0	14.6	o	o	o	—	o	26.0	16.8	21.4

*Data presented through the courtesy of the Dominion Experimental Stations.

o No results obtained at Swift Current in 1941.

Note: In none of these tests (excepting for Indian Head in 1942) was there appreciable damage to any variety from either spring frost or rust.

TABLE 3.—Seed yields on summer fallow in bushels per acre at 185 different locations in Saskatchewan in 1940, 1942, 1943, 1944 and 1945, averaged according to cereal variety zones. *

Year	Zones	Number of Co-op Tests	Royal	Redwing	Koto	Victory	Crystal	Arrow	Viking
1940..	1A, 1B, 2F	5	11.6	10.4	—	✓	—	—	—
	2A, 2B, 2E	19	14.6	12.3	—	—	—	—	—
	3D, 3E, 3F	10	12.6	14.6	—	—	—	—	—
1942..	1A, 1B, 2F	3	15.0	14.4	—	—	—	—	—
	2A, 2B, 2D, 2E	5	13.6	13.1	—	—	—	—	—
	3A, 3C	5	17.7	13.6	—	—	—	—	—
	3D, 3E, 3F, 4B	3	15.5	16.6	—	—	—	—	—
1943..	1A, 1B, 2F	5	5.4	7.2	5.2	6.4	—	—	—
	2A, 2B, 3A, 3E	7	8.6	12.7	11.6	11.3	—	—	—
	3B, 3D, 3F, 4A	4	6.7	7.2	6.6	8.0	—	—	—
1944..	1A, 1B, 2F	10	7.8	4.8	6.5	8.2	7.4	6.8	—
	2A, 2B, 2E, 2D	15	12.1	9.1	11.2	13.0	12.7	12.3	—
	3A, 3B, 3C	9	9.6	9.5	10.9	12.7	11.3	11.1	—
	3E, 3D, 4A	11	10.2	8.4	11.5	13.0	13.5	11.0	—
1945	1A, 1B, 2F	15	6.2	—	—	—	—	—	5.0
	2A, 2B, 2E, 2D	17	9.7	—	—	—	—	—	7.9
	3A, 3B, 3C	21	13.1	—	—	—	—	—	11.7
	3E, 3F, 4A, 4B	21	11.0	—	—	—	—	—	10.4

*This data reproduced through the courtesy of the Saskatchewan Wheat Pool.

NEW VARIETIES UNDER TEST

The following are new varieties recently distributed in the Dakotas and Minnesota but not licensed for sale in Canada (as at March 15, 1944).

Koto has medium sized brown seeds, is resistant to rust and wilt, has

straw of moderate length and strength, is high in percentage of oil, does not yield as well as Royal, but is earlier.

inferior? Victory has very large brown seeds, is resistant to rust and wilt, yields lower than Royal ~~but better than~~ Bison, ~~and~~ Redwing, has slightly shorter, stronger straw than Royal, equals it in percentage of oil, and is earlier. *and more*

Crystal has large greenish yellow seeds, is resistant to rust and wilt, has straw of moderate length and strength, yields the same as Victory, is as late as Royal and equals it in percentage of oil.

Arrow has medium sized brown seeds, is resistant to rust and wilt, is as late as Royal but slightly taller and has about the same quality and yield as Victory.

discon resistant